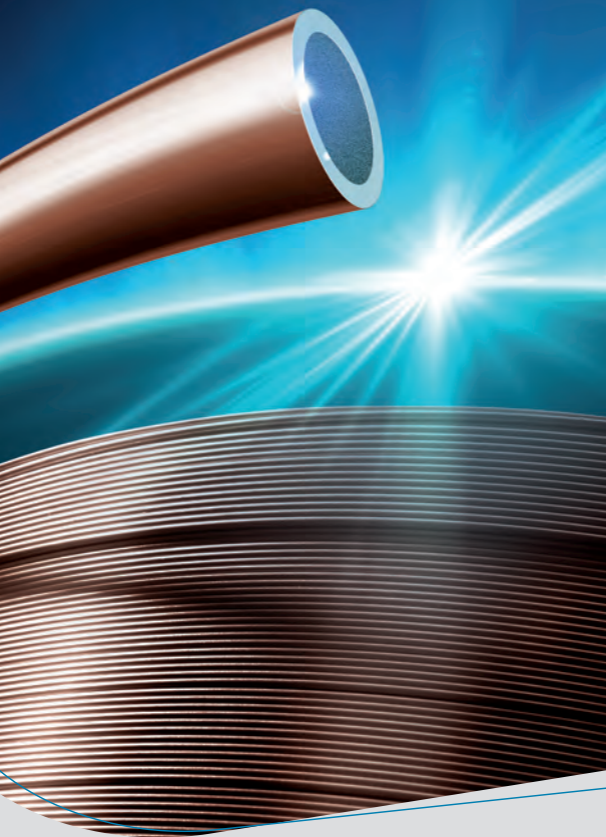




Welder Guide

Böhler Welding Seamless
Cored Wires

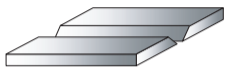


voestalpine Böhler Welding
www.voestalpine.com/welding

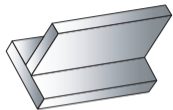
voestalpine

ONE STEP AHEAD.

EN and AWS Welding Positions/ butt & fillet welds



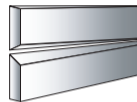
PA/1G



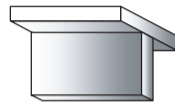
PA/1F



PB/2F



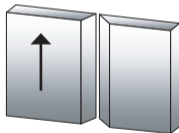
PC/2G



PD/4F



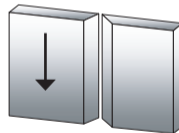
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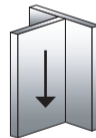
PF/3G



PF/3F



PG/3G



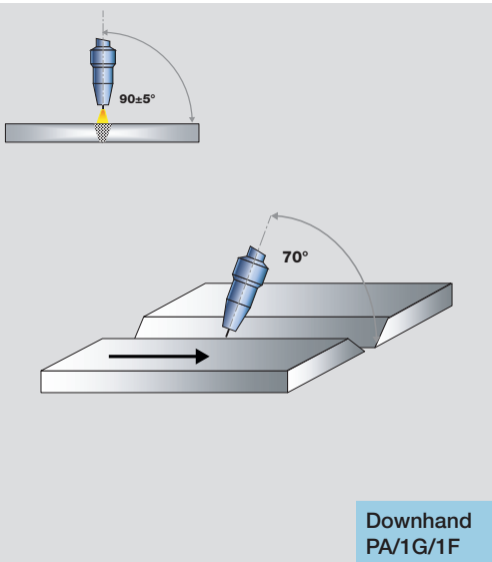
PG/3F

Overview of Product Family All-Positional Rutile

Product name	EN classification	AWS classification
BÖHLER Ti 52 T-FD	17632-A: T46 4 P M 1 H5	A5.36: E71T1-M21A4-CS1-H4
BÖHLER Ti 52 T-FD (CO ₂)	17632-A T46 3 P C 1 H5	A5.36 E71T1-C1A2-CS1-H4
BÖHLER Ti 52 T-FD (HP)	17632-A: T46 5 P M 1 H5	A5.36 E71T1-M21A6-CS1-H4
BÖHLER Ti 52 T-FD SR (CO ₂)	17632-A T42 4 P C 1 H5	A5.36 E71T12-C1AP4-CS1-H4
BÖHLER NiCu1 Ti T-FD	17632-A T46 4 Z P M 1 H5	A5.36 E81T1-M21A4-GH4
BÖHLER Ti 60 T-FD	17632-A T 50 6 1Ni P M 1 H5	A5.36 E81T1-M21A8-Ni1-H4
BÖHLER Ti 60 T-FD SR	17632-A T50 6 1Ni P M 1 H5	A5.36 E81T1-M21AP8-Ni1-H4
BÖHLER Ti 60 T-FD (CO ₂)	17632-A T46 4 1Ni P C 1 H5	A5.36 E81T1-C1A4-Ni1-H4
BÖHLER Ti 60 K2 T-FD (CO ₂)	17632-A T50 6 1.5Ni P C 1 H5	A5.36 E81T1-C1A8-K2-H4
BÖHLER Ti 2 Ni T-FD	17632-A T50 6 2Ni P M 1 H5	A5.36 E81T1-M21A8-Ni2-H4
BÖHLER Ti 75 T-FD	18276-A T62 4 Mn1.5Ni P M 1H5	A5.36 E101T1-M21A4-K2-H4
BÖHLER Ti 80 T-FD	18276-A T69 6 Z P M 1 H5	A5.36 E111T1-M21A8-GH4
BÖHLER Ti 70 Pipe T-FD	18276-A T55 5 Mn1Ni P M 1 H5	A5.36 E91T1-M21A6-K2-H4

Overview of Product Family All-Positional Rutile

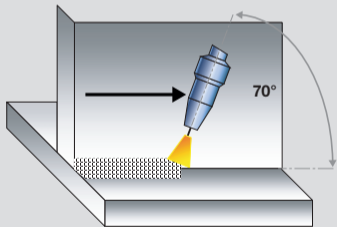
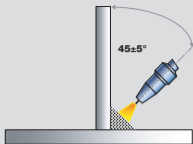
Product name	Application	CVN toughness	ABS steel grades
BÖHLER Ti 52 T-FD	Multi-purpose up to 460MPa YS. Mixed gas and CO ₂ .	60J at -40°C	EH36-EH40
BÖHLER Ti 52 T-FD (CO ₂)	Multi-purpose up to 460MPa YS. 100% CO ₂ .	70J at -30°C	DH36
BÖHLER Ti 52 T-FD (HP)	Highest toughness demands up to 460MPa YS. Mixed gas and CO ₂ .	80J at -50°C.	EH36-EH40
BÖHLER Ti 52 T-FD SR (CO ₂)	Multi-purpose up to 420 MPa YS. CTOD. PWHT. 100% CO ₂ .	85J at -40°C	EH36-EH40
BÖHLER NiCu1 Ti T-FD	Weathering steels. Mixed gas.	70J at -40°C	not applicable
BÖHLER Ti 60 T-FD	Low temperature steels up to 500MPa. < 1%Ni. CTOD. Mixed gas.	65J at -60°C	FQ43-FQ47 - FH40
BÖHLER Ti 60 T-FD SR	Low temperature steels up to 500MPa. < 1%Ni.PWHT. CTOD. Mixed gas.	90J at -60°C	FQ43-FQ47 - FH40
BÖHLER Ti 60 T-FD (CO ₂)	Low temperature steels up to 460MPa. < 1%Ni. CTOD. 100 % CO ₂ .	80J at -40°C	EH36-EH40
BÖHLER Ti 60 K2 T-FD (CO ₂)	Low temperature steels up to 500MPa. 100 % CO ₂ .	60J at -60°C	FQ43-FQ47 - FH40
BÖHLER Ti 2 Ni T-FD	Low temperature steels up to 500MPa. 2%Ni. CTOD. Mixed gas.	80J at -60°C	FQ43-FQ47-FH40
BÖHLER Ti 75 T-FD	High strength steels up to 620MPa. Mixed gas.	90J at -40°C	EQ51 - EQ56-EQ63
BÖHLER Ti 80 T-FD	High strength steels up to 690MPa. Mixed gas.	75J at -40°C	EQ70
BÖHLER Ti 70 Pipe T-FD	Pipeline steel grades up to X70. Mixed gas.	80J at -50°C	API 5L: X70



Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage	Run
	mm	inch	mm	inch	V	
					PA/1G/1F	
1.0	0.040	15	0.6	120-150	18-20	Root
				200-240	23-25	Fill
1.2	0.045	15	0.6	150-180	19-20	Root
				240-300	25-28	Fill
1.4	0.055	20	0.8	160-200	20-25	Root
				250-340	24-32	Fill
1.6	0.063			Not recommended		Root
				250-360	26-33	Fill

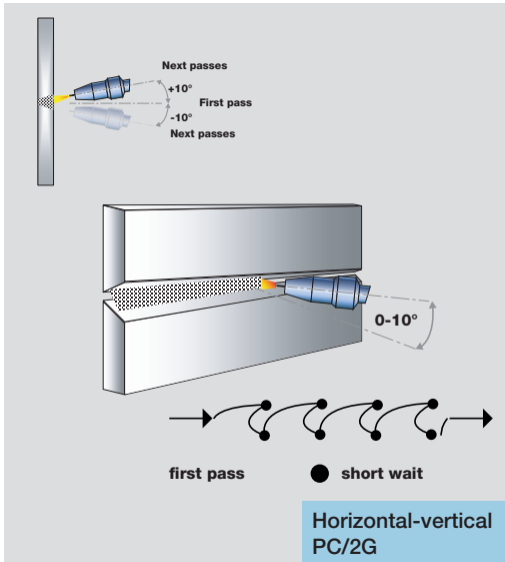


Flat Fillet
PB/2F

Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

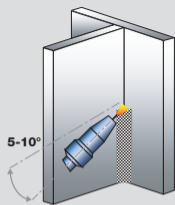
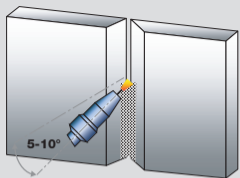
Ø	Stick-out		Welding current		Arc voltage	Run
	mm	inch	mm	inch	V	
					PB/2F	
1.0	0.040	15	0.6	210-250	20-24	Fill
1.2	0.045	15	0.6	200-320	24-31	Fill
1.4	0.055	20	0.8	220-360	24-32	Fill
1.6	0.063	20	0.8	230-400	25-33	Fill



Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

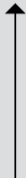
Ø	Stick-out		Welding current		Arc voltage	Run
	mm	inch	mm	inch	V	
					PC/2G	
1.0	0.040	15	0.6	140-190	18-20	Root
				200-230	20-22	Fill
1.2	0.045	15	0.6	150-190	19-21	Root
				200-250	21-25	Fill
1.4	0.055	20	0.8	160-210	20-25	Root
				220-300	23-29	Fill
1.6	0.063	20	0.8	Not recommended		Root
				230-310	24-30	Fill



First pass



Next passes

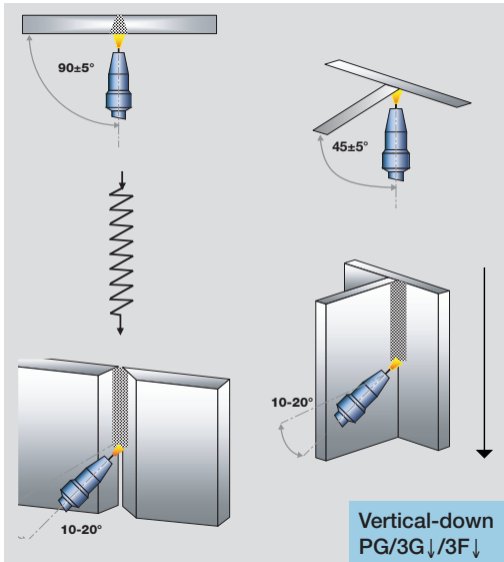


Vertical-up
PF/3G↑/3F↑

Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

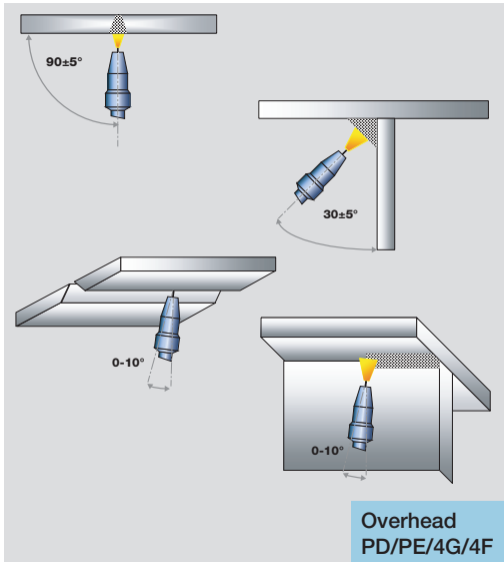
Ø	Stick-out		Welding current		Arc voltage		Run
	mm	inch	mm	inch	A	V	
					PF/3G↑	3F↑	
1.0	0.040	15	0.6	140-170	19-22		Root
				190-240	170-210	22-25	22-24
1.2	0.045	15	0.6	140-180	20-22		Root
				200-240	210-250	23-26	23-26
1.4	0.055	20	0.8	200-240	23-26		Root
					210-250		23-26
1.6	0.063	20	0.8	Not recommended			Root
				210-270	210-260	23-27	23-27



Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage		Run
	mm	inch	mm	inch	A	V	
					PG/3G↓	3F↓	
1.0	0.040	15	0.6	130-170	17.5-22		Root
						190-280	20-28
1.2	0.045	15	0.6	150-180	18-23		Root
						200-300	22-30



Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

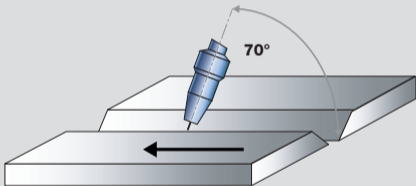
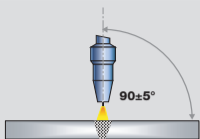
Ø	Stick-out		Welding current		Arc voltage		Run
	mm	inch	mm	inch	V		
					PD/PE/4G	4F	
1.0	0.040	15	0.6	120-150	18-21		Root
				160-200	170-200	19-23	20-22
1.2	0.045	15	0.6	140-170	18-21		Root
				170-230	200-230	19-24	21-23
1.4	0.055	20	0.8	Not recommended			Root
				180-220	20-23	210-240	22-25
1.6	0.063			Not recommended			

Overview of Product Family All-positional Metal-Cored

Product name	EN classification	AWS classification
BÖHLER HL 51 T-MC	17632-A T 46 6 M M 1 H5	A5.36 E70T15-M21A8-CS1-H4
BÖHLER HL 46 GS T-MC	17632-A T 46 Z M M 1 H5	A5.36 E70T15-M21AZ-CS1-H4
BÖHLER NiCu1 T-MC	18276-A T 46 6 Z M M 1 H5	A5.36 E80T15-M21A8-GH4
BÖHLER HL 53 T-MC	17632-A T 50 6 1Ni M M 1 H5	A5.36 E80T15-M21A8-Ni1-H4
BÖHLER HL 65 T-MC	18276-A T 55 4 1NiMo M M 1 H5	A5.36 E90T15-M21A4-K3-H4
BÖHLER HL 75 T-MC	18276-A T 62 4 Z M M 1 H5	A5.36 E101T15-M21A4-G-H4
BÖHLER 700 T-MC	18276-A T 69 6 Mn2NiCrMo M M 1 H5	A5.36 E110T15-M21A8-K4-H4
BÖHLER 900 T-MC	18276-A T 89 6 Z M M 1 H5	A5.28: E120C-H4
BÖHLER DMO T-MC	17632-A T 46 2 Mo M M 1 H5	A5.36 E80T15-M21P0-A1-H4
BÖHLER DCMS T-MC	17634-A T CrMo1 M M 1 H5	A5.36 E80T15-M21PY-B2-H4
BÖHLER CM2 T-MC	17634-A T CrMo2 M M 1 H5	A5.36 E90T15-M21PY-B3-H4
BÖHLER HL 60 Pipe T-MC	17632-A T 46 6 Z M M 1 H5	A5.36 E80T15-M21A8-K6-H4

Overview of Product Family All-positional Metal-Cored

Product name	Application	CVN toughness	ABS steel grade
BÖHLER HL 51 T-MC	Multi-purpose up to 460MPa YS. Mixed gas and CO ₂ .	60J at -60°C	FQ43-FQ47-FH40
BÖHLER HL 46 GS T-MC	Galvanized steel plates. Mixed gas.	not applicable	not applicable
BÖHLER NiCu1 T-MC	Weathering steels. Mixed gas.	70J at -60°C	not applicable
BÖHLER HL 53 T-MC	Low temperature steels up to 500MPa. < 1%Ni. CTOD. Mixed gas.	90J at -60°C	FQ43-FQ47 - FH40
BÖHLER HL 65 T-MC	Ni-Mo alloyed for steels up to 550MPa. Mixed gas.	70J at -50°C	FQ56-FQ51-FQ-47
BÖHLER HL75 T-MC	ASTM A519 Gr. 4130. < 1%Ni. Mixed gas.	70J at -40°C	DQ63
BÖHLER 700 T-MC	Ni-Mo-alloyed wire for high strength steels up to 690 MPa YS. Mixed gas.	70J at -60°C	EQ70
BÖHLER 900 T-MC	Ni-Cr-Mo alloyed for high strength steels up to 890MPa. Mixed gas.	55J at -60°C	not applicable
BÖHLER DMO T-MC	For 0.5% Mo type creep resistant steels. PWHT. Mixed gas.	90J at -20°C	not applicable
BÖHLER DCMS T-MC	For 1% Cr-0.5% Mo type creep resistant steels. PWHT. Mixed gas.	80J at -20°C	not applicable
BÖHLER CM2 T-MC	For 2.25% Cr-0.5% Mo type creep resistant steels. PWHT. Mixed gas.	110J at +20°C	not applicable
BÖHLER HL 60 Pipe T-MC	Pipeline steel grades up to X70. CTOD. Mixed gas.	140J at -60°C	API 5L: X70

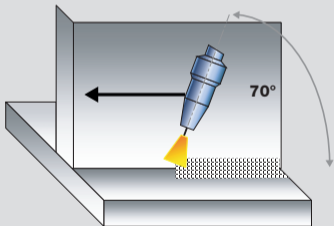
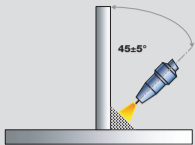


Downhand
PA/1G/1F

Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage		Run	
	mm	inch	mm	inch	V			
					PA/1G	1F		
1.0	0.040	15	0.6	100-140		18-21		Root
				220-270	230-270	23-26	25-28	Fill
1.2	0.045	15	0.6	150-180		18-20		Root
				250-320	240-320	27-30	24-31	Fill
1.4	0.055	20	0.8	170-200		21-23		Root
				270-350	210-360	29-32	24-32	Fill
1.6	0.063	20	0.8	Not recommended				Root
				300-400	230-400	29-32	25-33	Fill

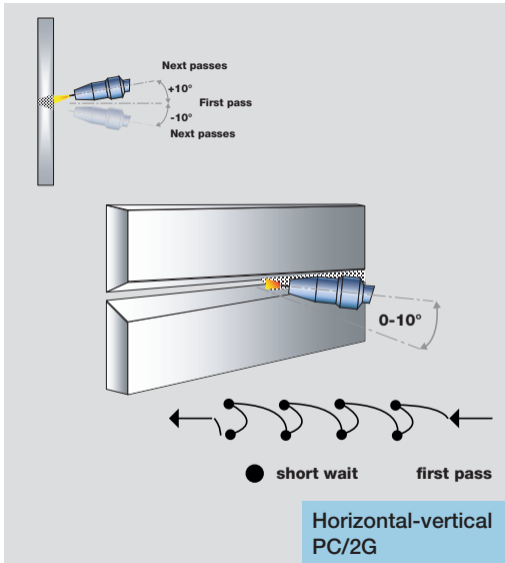


Flat Fillet
PB/2F

Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

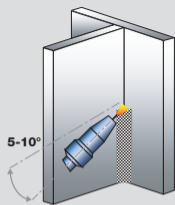
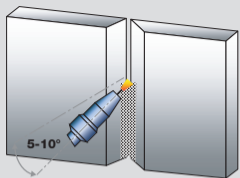
Ø		Stick-out		Welding current	Arc voltage	Run
mm	inch	mm	inch	A	V	
				PB/2F	PB/2F	
1.0	0.040	15	0.6	230-270	25-28	Fill
1.2	0.045	15	0.6	240-320	24-31	Fill
1.4	0.055	20	0.8	210-360	24-32	Fill
1.6	0.063	20	0.8	230-400	25-33	Fill



Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

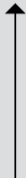
Ø	Stick-out		Welding current		Arc voltage	Run
	mm	inch	mm	inch	V	
				PC/2G	PC/2G	
1.0	0.040	15	0.6	110-140	18-21	Root
				190-230	23-26	Fill
1.2	0.045	15	0.6	150-170	19-21	Root
				200-260	21-26	Fill
1.4	0.055	20	0.8	160-210	20-25	Root
				220-280	23-27	Fill
1.6	0.063	20	0.8	Not recommended		Root
				230-300	24-29	Fill



First pass



Next passes

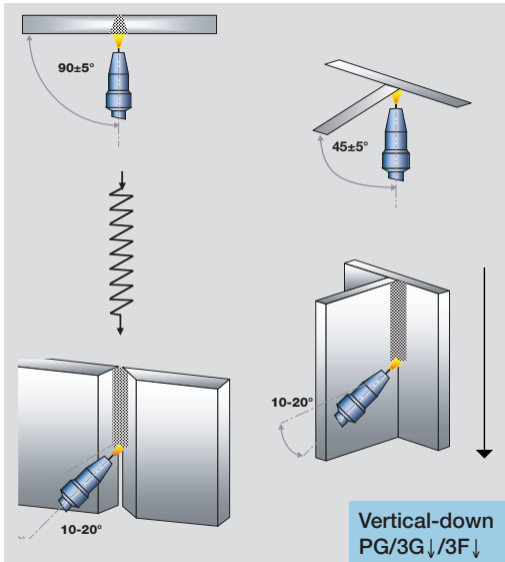


Vertical-up
PF/3G↑/3F↑

Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage		Run
	mm	inch	mm	inch	A	V	
					PF/3G↑	3F↑	
1.0	0.040		15	0.6	100-130	19-20	Root
					130-170	130-160	18-22
1.2	0.045		15	0.6	130-160	17-21	Root
					170-190	140-170	19-21
1.4	0.055				Not recommended		
1.6	0.063				Not recommended		

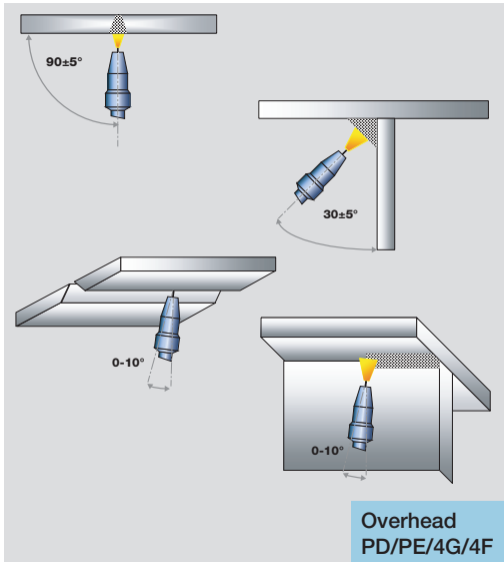


Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage		Run
	mm	inch	mm	inch	A	V	
					PG/3G↓	3F↓	
1.0	0.040		15	0.6	140-170	18-22	Root*
						230-250	23-26
1.2	0.045		15	0.6	150-180	18-21	Root*
						250-280	24-28

* Usually one layer weld.



Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

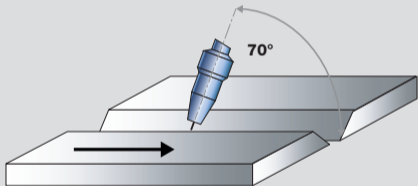
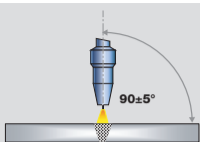
Ø	Stick-out		Welding current		Arc voltage		Run
	mm	inch	mm	inch	V		
					PD/PE/4G	4F	
1.0	0.040	15	0.6	110-140	18-21		Root
				160-210	180-230	21-24	21-24
1.2	0.045	15	0.6	140-170	18-21		Root
				180-240	190-240	21-25	22-25
1.4	0.055	20	0.8	Not recommended			Root
				210-240	210-240	22-25	22-24
1.6	0.063			Not recommended			

Overview of Product Family - Basic

Product name	EN classification	AWS classification
BÖHLER Kb 46 T-FD	17632-A T 42 4 B M 1 H5	A5.36 E70T5-M21A4-CS1-H4
BÖHLER Kb 52 T-FD	17632-A T 46 4 B M 3 H5	A5.36 E70T5-M21A4-CS1-H4
BÖHLER Kb NiCu1 T-FD	17632-A T 46 6 Z B M 3 H5	A5.36 E80T5-M21A8-GH4
BÖHLER Kb 60 T-FD	17632-A T 46 6 1Ni B M 3 H5	A5.36 E80T5-M21P8-Ni1-H4
BÖHLER Kb 63 T-FD	18276-A T 55 4 Z B M 3 H5	A5.36 E90T5-M21A4-GH4
BÖHLER Kb 65 T-FD	18276-A T 55 4 1NiMo B M 3 H5	A5.36 E90T5-M21A4-GH4
BÖHLER Kb 85 T-FD	18276-A T 69 6 Mn2NiCrMo B M 3 H5	A5.36 E110T5-M21A8-K4-H4
BÖHLER Kb 85 T-FD (CO ₂)	18276-A T 69 4 Mn2NiCrMo B C 3 H5	A5.36 E110T5-C1A4-K4-H4
BÖHLER Kb 90 T-FD	18276-A T 89 4 Mn2Ni1CrMo B M 3 H5	A5.36 E120T5-GM-H4
BÖHLER DMO Kb T-FD	17632-A T 46 6 Mo B M 3 H5	A5.36 E80T5-M21P8-A1-H4
BÖHLER DCMS Kb T-FD	17634-A T CrMo1 B M 3 H5	A5.36 E80T5-M21PY-B2-H4
BÖHLER CM2 Kb T-FD	17634-A T CrMo2 B M 3 H5	A5.36 E90T5-M21PY-B3-H4
BÖHLER DCMV Kb T-FD	17634-A T Z B M 3 H5	A5.36 E90T5-M21PY-GH4
BÖHLER CM5 Kb T-FD	17634-A T CrMo5 B M 4 H5	A5.36 E80T5-M21PY-B6-H4

Overview of Product Family - Basic

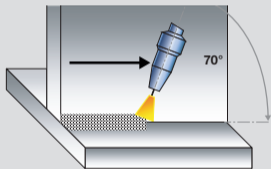
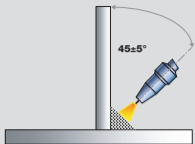
Product name	Application	CVN toughness	ABS steel grade
BÖHLER Kb 46 T-FD	Steel up to 420MPa YS. CO ₂ .	-60°C.	EH36
BÖHLER Kb 52 T-FD	Steel up to 460MPa YS. Mixed gas and CO ₂ .	80J at -60°C.	EH36
BÖHLER Kb Ni1Cu T-FD	Weathering steels. Mixed gas and CO ₂ .	130J at -60°C	not applicable
BÖHLER Kb 60 T-FD	Low-temperature steels up to 460 MPa yYS. <1% Ni.	80J at -60°C.	FQ51-FQ47-FQ43
BÖHLER Kb 63 T-FD	Cr-Ni-Mo alloyed for high strength steel up to 550MPa YS. Mixed gas.	80J at -40°C.	EQ47-EQ51 - EQ56
BÖHLER Kb 65 T-FD	Cr-Ni-Mo alloyed for high strength steel up to 550MPa YS. Mixed gas.	100J at -40°C.	EQ47-EQ51 - EQ56
BÖHLER Kb 85 T-FD	Ni-Mo-alloyed wire for high strength steels up to 690 MPa YS. Mixed gas.	80J at -60°C.	FQ70
BÖHLER Kb 85 T-FD (CO ₂)	Ni-Mo-alloyed wire for high strength steels up to 690 MPa YS. CO ₂ .	80J at -40°C	EQ70
BÖHLER Kb 90 T-FD	Ni-Mo-alloyed wire for high strength steels up to 890 MPa YS. Mixed gas.	75J at -40°C.	NA
BÖHLER DMO Kb T-FD	For 0.5% Mo type creep resistant steels. Mixed gas.	130J at -60°C.	NA
BÖHLER DCMS Kb T-FD	For 1% Cr-0.5% Mo type creep resistant steels. Mixed gas.	>100J at 75J at +20°C.	NA
BÖHLER CM2 Kb T-FD	For 2.25% Cr-0.5% Mo type creep resistant steels. Mixed gas.	>100J at +20°C	NA
BÖHLER DCMV Kb T-FD	For Cr-Mo-V- alloyed creep resistant steels (G17CrMoV5-10). Mixed gas.	100J at +20°C	NA
BÖHLER CM5 Kb T-FD	For 5% Cr-0.5% Mo type creep resistant steels. Mixed gas.	100J at +20°C	NA

Downhand
PA/1G/1F

Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage	Run
	mm	inch	mm	inch	V	
					PA/1G/1F	
1.0	0.040	15	0.6	130-160	19-21	Root
				220-250	21-24	Fill
1.2	0.045	15	0.6	130-150	17-20	Root
				220-310	22-30	Fill
1.4	0.055	20	0.8	170-200	20-22	Root
				220-360	24-32	Fill
				Not recommended		Root
				270-400	27-34	Fill

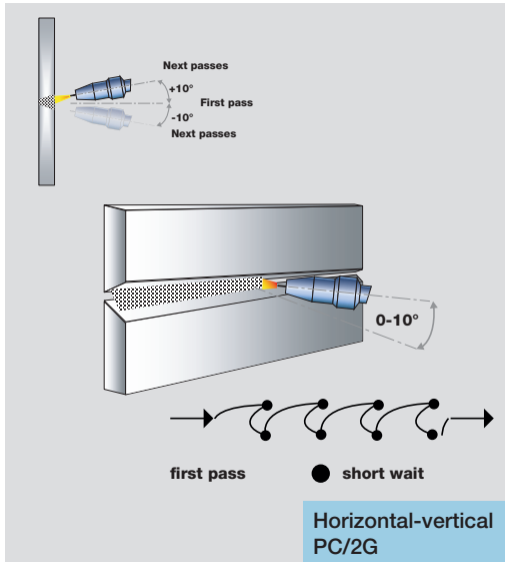


Flat Fillet
PB/2F

Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage	Run
	mm	inch	mm	inch	V	
					PB/2F	
1.0	0.040	15	0.6	230-250	24-26	Fill
1.2	0.045	15	0.6	230-310	22-30	Fill
1.4	0.055	20	0.8	270-350	22-30	Fill
1.6	0.063	20	0.8	260-400	27-34	Fill



Torch Positions and Welding Parameters

(Values for mixed gas - add 1.5-2V for CO₂)

Ø	Stick-out		Welding current		Arc voltage	Run
	mm	inch	mm	inch	V	
				PC/2G	PC/2G	
1.0	0.040	15	0.6	130-160	19-21	Root
				220-250	21-24	Fill
1.2	0.045	15	0.6	130-150	17-20	Root
				220-290	22-31	Fill
1.4	0.055	20	0.8	170-200	20-22	Root
				270-300	26-30	Fill
1.6	0.063	20	0.8	Not recommended		Root
				270-310	27-32	Fill

Welding know-how joins steel

Customers in over 120 countries join the expertise of voestalpine Böhler Welding. Focused on filler metals, voestalpine Böhler Welding offers extensive technical consultation and individual solutions for industrial welding and soldering applications. Customer proximity is guaranteed by 40 subsidiaries in 28 countries, with the support of 2,200 employees, and through more than 1,000 distribution partners worldwide.



Böhler Welding – More than 2,000 products for joint welding in all conventional arc welding processes are united in a product portfolio that is unique throughout the world. Creating lasting connections is the brand's philosophy in welding and between people.



UTP Maintenance – Decades of industry experience and application know-how in the areas of repair as well as wear and surface protection, combined with innovative and custom-tailored products, guarantee customers an increase in the productivity and protection of their components.



Fontargen Brazing – Through deep insight into processing methods and ways of application, Fontargen Brazing provides the best brazing and soldering solutions based on proven products with German technology. The expertise of this brand's application engineers has been formulated over many years of experience from countless application cases.